Assumptions about Acquisition[1]

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1. In this paper I propose to deal mainly with the problem of babbling, but treating it as an integral part of the process of phonological acquisition rather than as an autonomous process.

The essence of the mystery associated with babbling is, as Jakobson (1968) puts it, that whereas the child at the height of his babbling period is capable of producing all conceivable sounds, he then loses nearly all of this ability to produce sounds, in passing over to the first genuine stage of language (the first acquisition of words). Crucially, however, the child does not lose only those articulations lacking in the environment language, but (and this despite putative evidence that apparently neither the perceptual nor the production mechanisms are in themselves faulty at this stage) also many sounds common to the child's babbling and the adult language of the environment.

Now I do not wish to argue here, against Jakobson, the question of whether either the child's perception or production are in fact perfect for all segments in all positions and under all conditions of stress and intonation;[2] nor whether, considering the massive homonymy of output for the earliest stage, the 'true onset of language' is indeed definable (as Jakobson implies) in terms of the 'first acquisition of words';[3] nor, thirdly, whether the child's articulations are in fact even homologous with those of an adult for given similar segments[4]--though I think it fair to say that all these assumptions are open to serious question.

On the other hand, neither will it be necessary, for present purposes at least, to agree or disagree with Menyuk's contention that babbling develops in the same order of feature utilization as does (what she calls) the morpheme construction period;[5] or that Gruber's (1966) claim that babbling is always intentional--though not intendedly intelligible.

I want instead to explore some of the positive analogies between the progress of phonation in children, and the development of certain other highly organized activities that very young children (and other animals) are capable of. I shall argue that these analogies are material: and this is to claim that we do not have to do simply with a series of suggestive metaphors, but rather with a single unifying and explanatory principle--that of biological maturation, which underlies and accounts for not merely the onset of speech, as Lenneberg (1967) has held, but also much of its subsequent development, at least in the acquisition of phonology.[6]

2. Many of the neuromuscular functions of the newborn infant are organized into definite discernible patterns, three of the most striking of which are as follows (McGraw, 1966).

1. A newborn infant may grip a rod sufficiently to suspend his own body-weight in mid-air for several seconds or even minutes.

2. He will, when immersed in water in a prone position, manifest definite rhythmical swimming motions of his arms, legs, and trunk.

3. If supported under the arms in an upright position so that his feet can touch the floor, he will frequently engage in rhythmical stepping movements--making as many as ten to fifteen consecutive 'steps'.

Now I want to suggest that there is an important parallel between these patterns and that of infant phonation. However, the true nature of the maturation process is revealed only when we study the progressive change in each function from its inception until it attains a state of relative stability.

Take suspension-gripping. According to McGraw (see diagram A, pp. below), the intensity of this response (suspension-grasp ability) increases during the first thirty days. Then there is a decline, during which (at least) single-handed suspension is entirely suppressed. There follows a period of fluctuating ability from about 100-400 days, and finally a renewed steady increase--the ability of a 30-day old infant not being equalled again until after about 4 years.

We thus see four phases: the neonate seems to show increasing ability, then nearly total loss of ability, then disorganization and confusion, and finally, smoothly integrated action.[7]

With variations in the duration of each phase and in the overlap between phases, the other neonate behavior patterns mentioned show parallel developmental schedules: reflex, inhibition, transition, smooth coordination. Now the analogy to phonetic behavior is irresistible--where the corresponding stages would be babbling, relative muteness, substitution and mature ability. While the neurophysiological explanation of the pattern I have illustrated is not clear in detail, it is reasonable to assume a transfer of control systems, in turn correlating with the child's dawning consciousness that meaning is to be associated with sound. If McGraw is right in her supposition, this shift of control [perhaps from lower to higher centers[8]] involves massive inhibition of the earlier control system--and this it is that results in a temporary cessation of function.

3. My second argument is that, despite this inhibition phase, there are in fact important continuities between the earliest vocalizations and speech proper. I shall cite four examples: infant cries, breathing rhythm, syllable-structure, and Register phenomena.[9]

First, consider infant cries and screams. The commonest vowels heard in infant crying are [a] and [æ], vowels the frontal quality of which can hardly be attributed--as some would seem to wish it to be--to the fact that the child is lying on its back! Rather, it suggests that new-born infants cry with a rigid tract, as Lieberman (1968) claims--and if this is so, then there is a curious anticipation here of the so-called speech-neutral tract in the adult--which is (at least for English--see Perkell (1969)) such as would produce some kind of mid-to-low front vowel.[10]

Next, let me refer to early control of the rhythm of speech-breathing. It is well known of course that speech-breathing is quite different from rest-breathing--inspiration being markedly shorter than expiration. Now the fact that babbling frequently consists of sequences of up to five syllables at a time shows that for the period of babbling this particular part of the speech program is already operative. [I note in passing that the swimming behavior of the infant, referred to above, is accompanied by yet another reflex ability--later lost; instead of coughing or swallowing water, the infant simply holds his breath.]

A third element that carries over from babbling, at least into the early stage of imitation, is the syllable shape CV itself,[11] together with the tendency to perseveration, i.e. reduplication of the shape CV[12]--a universal characteristic of early child language.

Perhaps the most striking of the features carried over from the earliest stages into even mature language use, are those known as Registers--those features of production conveying information or emotion beyond that conveyed by the words alone (Cf. Weeks (1970)). I refer here to two of these, whisper and whining.

(1) Whisper. Children very early master the register use of whisper. But note too that whisper may first appear in babbling. Preyer (1914) refers to whispered babble monologues, as does Gutzmann (1894). In turn, early imitative forms in whispered speech are given in Leopold (1947) at 12 months. We also see in the Leopold data the gradual transfer to adult use of whisper: at 17 months, child-type use is becoming rare, while by 20 months[13] the adult use is fully established.

(2) Whining. Lastly, I mention the register we might call whining, used for complaining and frustration crying by most children. Note that whining is characterized by an open velum, whence of course the nasal quality: but this is precisely the configuration (viz., nasalization) used by the newborn infant wailing in discomfort--cf. Lewis (1936).

I now claim that, since a number of important elements of speech carry over from babbling into mature language use, the inhibition I talked of may not be referred to as the inhibition of an ability--but only of performance, or output. It is thus only temporary suppression of output that characterizes the change-over of control programs for a given function, as my labelling of the graph (A, page 79) indicates.

4. My third argument is this: if my global analogy between phonological development and the schedules of neuro-muscular development is correct, then of course the stage of phonetic substitutions ought to show the characteristics of the third stage of maturation, viz., disorganization and confusion. A typical complex movement pattern such as walking shows in its development:

1. plateaus and spurts.
2. regressions and reversals.

Let me take a small problem in phonetic (production) acquisition to illustrate the apparent parallel in language.

In a longitudinal study of differential vowel length in American English at the University of Wisconsin, Naeser (1970) has shown that, for some vowels at least, differential length seems to fluctuate and even to reverse, until at length it stabilizes at its English-specific norms.

However, I want to suggest that this conclusion presents only an apparent parallel--for there is of course far more complexity to both walking and language than appears so far. In particular, as McGraw is careful to point out, even where some part of the pattern seems to lag behind, there is overall development going on all the time. Thus, reflex stepping is inhibited for the time during which postural (anti-gravity) control is improving; only then does the further voluntary control of progressive movement become possible.

For the parallel with language, however, a rather wider range of vowels than that handled in Naeser's paper is required: I shall use the data in Velten (1943).

The data under (B) on page is a sample from Velten's six stages[14] in the development of differential vowel length in the English of his daughter Joan.

At 11-20 months, vowel length depends simply on (underlying,[15] not produced) syllable structure; thus, final l counting as syllable, doll has a long vowel as well as pie, both counting as open syllables.

At 23 months, vowels are first differentiated by length in closed syllables. But notice that it is the low vowel [a] that is lengthened--low vowels being universally longer than non-low vowels, context for context.

At 24 months, a series of interlocking reorganizations occurs. At stage (a), two further contextual lengthening factors come into play; the universal lengthenings by a following voiced stop or voiced spirant. As at the earliest stage, the 'environment' for this change is the representation, not the produced segment (as Naeser's study also showed): thus wet is [wut] but red is [wu·t]--i.e., lengthening occurs on the basis of the underlying (heard) representation.

At stage (b), underlying voiced stops are produced at length as voiced--but only word-finally, in the environment newly affected by vowel-lengthening.

At stage (c), following this, the underlying vowels [ʌ] and [ɛ], (non-high non-round, produced as [a, u]) lose their newly-acquired length. The fact that these are Lax vowels suggests that what is being 'acquired' is mastery of the Tense-Lax distinction, a notion confirmed by the final phase given here.

Fourth and lastly, at stage (d), the underlying vowels [i, e, o, ə, u] are produced as long [u.] under stress. But these are the (non-low) Tense vowels, which universally are intrinsically longer than their Lax counterparts.

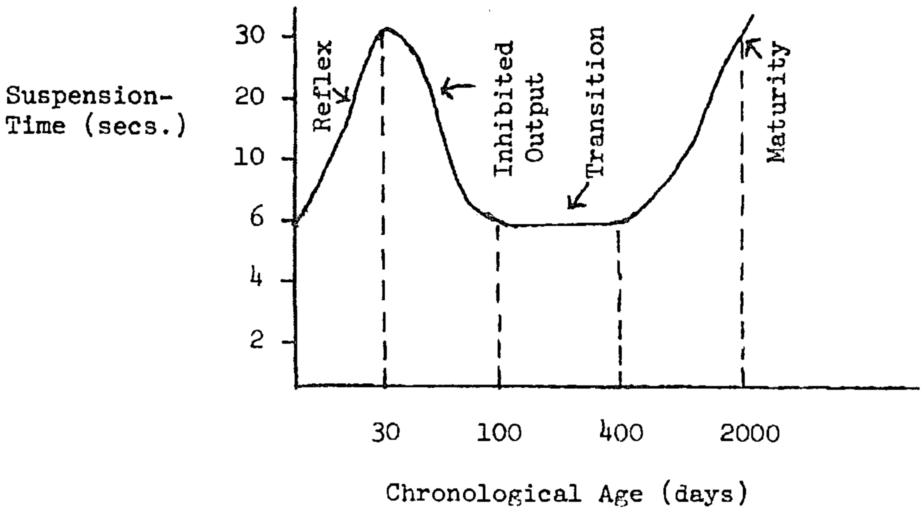
Summarizing now from the two right-hand columns of the data (b, page): at stage 1, control is by syllable structure alone; while at stage 2 appears the intrinsic length of the vowel [a], added in closed syllables. Stages 3-6 show the stages in the developing importance of the Tense-Lax distinction--thus with Stage 3 the influence of following voiced stops and spirants; with Stage 4, final stops and spirants are at length distinguished for voicing; while in the final stages (5-6), the Tense-Lax distinction finally spills back into the major part of the vowel system, with appropriate length adjustments.[16]

The moral of my story is a double one. Although the vowel in a word such as 'mud' must have been short at stage 2, it is then long at stage 3, but then short again at stage 5--thus showing apparently gross fluctuation over a period of only two months; but what is really happening is that an <u>ordered</u> series of interlocking adjustments across the system has taken place.[17] But it is also important to note that the representation that must underlie these processes is a stable one, and can only be one essentially identical with that of the adult model.

5. To sum up, the development of a child's phonetic output in language acquisition correlates in gross outline with the phases of neuromuscular development established for other patterns of complex movement, these phases being: reflex pattern; temporary inhibition of output; transitional stage of interlocking re-organization of sub-systems; and mature, smoothly achieved functioning.

The hypothesis of this paper is that these correlations are not accidental; not merely in onset (the babbling stage) but for a great deal of its later development, language shows the hallmarks of a complex innate maturation process. The laws controlling this process and especially its interaction with learning in the usual sense--remain to be clarified.

(A) Grip-suspension in the new-born child [Modified from McGraw 1966]



(B) Acquisition of contextual vowel-length (Data from Velten 1943)

						Stage	Dominant factor
11-20 months		ba da	'bottle' 'down'	ba· da·	'pie' 'doll'	1	Syllable structure
23 months		dap but	'cup' 'bread'	da·p da·t	'top' 'dark'	2	Cá·C
24 months	(1)	nat wut dus	'nut' 'wet' 'goose'	ma·t wu·t nu·s	'mud' 'red' 'nose'	3	V → Long before {voiced stop / voiced spirant}
	(2)	dut wut dus	'coat' 'wet' 'goose'	ma·d wu·d nu·z	'mud' 'red' 'nose'	4	Stops & Spirants → Voiced ≠ Voiceless in final position
	(3)	wut mad wud	'wet' 'mud' 'red'			5	Re-shortening of least marked Lax vowels
	(4)			du·t du·s	'coat' 'goose'	6	Non-Low Tense vowels → Long

Footnotes

1. Paper read at the LSA Meeting, December 1970. For the present publication (1973), only minor stylistic changes have been made. (But cf. footnotes 6 and 14).

2. Consider, for example (a) arguments from child confusions of comprehension, e.g., Abbs, Minfie (1969); and (b) arguments from acoustic cues in final stops vs. spirants.

3. A question of ascertaining an <u>intention</u> regarding meaning-sound correspondence, for a stage when <u>all</u> forms have, say, [ba] as their output.

4. Cf. Preyer (1914), p. 110--in crying [rrra] at 11 months, Axel Preyer showed "a vibration on both sides of the edges of the tongue, which is bent to a half cylinder with the ridge upward".

5. From which it might perhaps be assumed that at least some late phase of babbling will show language-specific feature use: but cf. the negative findings on adult ability to discriminate between the babbling of young children from different linguistic communities, in Atkinson, et. al (1970).

6. Cf. the parallel intuition in Bever (1961), of which the author apprised me in January 1971.

7. For the swimming reflex, certainly, evidence suggests that such patterns are common at least to mammals--reflex swimming has been elicited from very young rats, kittens, rabbits and rhesus monkeys (McGraw, 1939).

8. Her earlier (1945 edition) explanation of such phenomena, based on a "geological" model of the brain, assumed the shift was from brain stem to cerebral cortex; later (1966 edition) with a "central systems" brain model, the shift is assumed to be from lower brain stem to Reticular Formation.

9. For a survey of the literature on intonation, see Kaplan (1970)--though there is some question of the relevance of habituation techniques of the kind there described to the problems of normal language acquisition.

10. A direct consequence of which is of course the <u>omission</u> of the Distinctive Feature "Front" in Chomsky-Halle (1968).

11. So strong a pattern as to lead to vowel prosthesis as an alternative to loss of a final consonant: thus #CVCV# alternates with #CVØ#, for an underlying #CVC# shape.

12. Cf. thumb-sucking, another example of repetitive response labelled "primary circular reaction" in Piaget (1954).

13. It can hardly be coincidental that this is the point at which Hildegard Leopold also completed the suppression of the tendency to voice by assimilation all pre-vocalic (i.e. initial and medial) consonants.

14. David Ingram has reminded me (personal communication, Feb. 1971) that in fact more than six stages are discernable in the data, especially the earliest stages. Since this fact only further confirms the present thesis, I have left the text unmodified.

15. That 'lengthening' is rule-guided, rather than merely a question of imitation, is clear from Naeser's study: 'long' vowels were always grossly overlength.

16. The fact that contextual vowel length is largely established while only two vowels are yet distinguished is a strong argument against the notion that distinctiveness dominates phonological acquisition. Not only do the facts contradict the notion "bi-unique phoneme", but non-distinctive features are obviously as important as distinctive ones at this period.

17. Of course the details of such a reorganization are expected to reflect individual strategies--which, in turn, is what makes statistical averaging perhaps less valuable than detailed longitudinal studies on single children.

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